**TODO 1**

|  |  |
| --- | --- |
| **Distribution** | **Histogram** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**TODO 2**

From the graph, we can see that the empirical mean is getting closer to 0 as the sample size increases. This implies that the empirical mean is converging to the theoretical mean, which is 0.

A graph of a function

Description automatically generated with medium confidence

**TODO 3**

From the graph, we can see that with the increase of sample size, the approximation given by the histogram is more similar to the true PDF.

|  |  |
| --- | --- |
|  | **Histogram** |
| With |  |
| With |  |
| With |  |
| With |  |

**TODO 4**

A graph of a number of blue lines

Description automatically generated

The resulting histogram looks like a normal distribution due to the Central Limit Theorem, which states that the sum of a large number of independent and identically distributed random variables tends towards a normal distribution.

**TODO 5**

A screen shot of a computer program

Description automatically generated

**TODO 6**

A computer screen shot of a program

Description automatically generated

**TODO 7**

To find , we need to calculate the following.





**TODO 8**

A screenshot of a computer program

Description automatically generated

**TODO 9**

1. Yes, the correlation decreases as we increase the randomness of A
2. Changing  from  to  is equivalent to adding 10000 to each sample of . This shifts the distribution of  but does not change its shape or spread. Therefore, it should not affect the correlation between  and , because correlation is not affected by shifts in the mean.

**TODO 10**

**A screen shot of a graph

Description automatically generated**

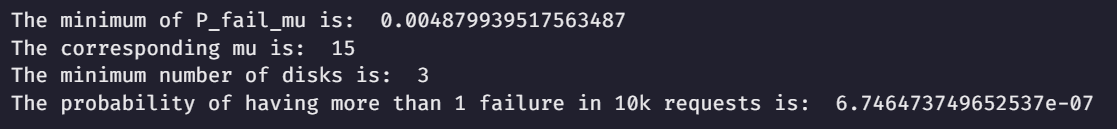
1. To minimize the failure, The probability of failure is



The minimum probability is when  by analyzing parabola graph.

1. The minimum probability is around 0.001
2. The probability of failure is around  when n is number of disks. That means if 

**TODO 10 (Continuous)**



4.1. Since the temperature distribution is normal distribution around , then the minimum failure chance must be at 15 Celsius.

4.2 The probability of failure is



After calculating, the result is around 0.0049

4.3 The probability of failure can be calculated similarly to 10.3 with changing of failure probability to 0.0049. After calculating the probability, the result is 

**TODO 11**

1.  are independent since their covariance is equal to 0.

|  |  |
| --- | --- |
|  |  |

1. Coin B has the highest probability

|  |  |
| --- | --- |
|  |  |

1. Because of the law of large number, The mean will converge into true mean that >1 which make the expected return positive.
2. 30 Days

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Strategy | Buy A | Buy B | Buy C | Buy D | Expected | Variance | Prob |
| 1 | 100 | 0 | 0 | 0 | 0.79 | 37.33 | 0.4541 |
| 2 | 0 | 100 | 0 | 0 | 0.57 | 10.64 | 0.5113 |
| 3 | 0 | 0 | 100 | 0 | 1.28 | 53.44 | 0.4664 |
| 4 | 0 | 0 | 0 | 100 | 1.40 | 72.59 | 0.4532 |
| 5 | 50 | 50 | 0 | 0 | 0.78 | 12.77 | 0.5273 |
| 6 | 50 | 0 | 50 | 0 | 1.22 | 32.26 | 0.5015 |
| 7 | 50 | 0 | 0 | 50 | 1.04 | 36.12 | 0.4816 |

180 Days

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Strategy | Buy A | Buy B | Buy C | Buy D | Expected | Variance | Prob |
| 1 | 100 | 0 | 0 | 0 | 6.99 | 1488.02 | 0.3855 |
| 2 | 0 | 100 | 0 | 0 | 4.14 | 143.45 | 0.5434 |
| 3 | 0 | 0 | 100 | 0 | 10.40 | 2452.51 | 0.4115 |
| 4 | 0 | 0 | 0 | 100 | 10.32 | 3967.58 | 0.3535 |
| 5 | 50 | 50 | 0 | 0 | 5.99 | 404.65 | 0.5521 |
| 6 | 50 | 0 | 50 | 0 | 8.90 | 1148.74 | 0.4674 |
| 7 | 50 | 0 | 0 | 50 | 8.46 | 1492.10 | 0.4282 |

1. 30 Days = strategy 4 180 Days = strategy 3
2. 30 Days = strategy 2 180 Days = strategy 2
3. Strategy has higher variance than Strategy 6 as same as 
4. The “good” plan can be defined with many objectives. In my opinion, the good plan must be > 50% Chance of getting expected return and the return must not be too low. That why I think strategy 6 is the optimal choice.